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SHOT BLASTING PROCESS

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5 Claims. (Cl. 72—53)

This application is a continuation-in-part of my co-pending application Ser. No. 320,536, filed Oct. 31, 1963, now abandoned.

This invention relates to a process for finishing the surfaces of soft, nonferrous metals and, more particularly, relates to a process for blasting such metals using synthetic resin particles to produce a high luster satin mat finish on the metal surface without substantial deformation of the metal surface treated and without creating a material amount of stress in the metal treated.

It is well known to surface finish metal pieces by blasting using sand, aluminum oxide or glass bead particles, with the particles being carried either in an air stream or in a liquid, such as water. Such particles are capable of forming mat finishes on metal surfaces but the treated surfaces have a relatively low luster and also the use of such particles creates undesirable stresses in the metal surface.

In a blasting process, the forces applied on the metal surface by the particles can be analyzed as including those acting substantially perpendicular to the metal surface which act topeen the surface and those acting substantially parallel to the metal surface which act to scour and clean the metal surface. When the abrasive particles are mechanically strong so that they are not easily broken by the impact force, and also have sharp edges, the peening action is accompanied by a cutting action in which the sharp edges cut through the surface layer and expose the metal underneath. Where the particles lack sharp cutting edges, only the peening action takes place. Where hard particles are used, particularly on thin workpieces made of a soft metal, such as aluminum, deformation of the surface of the workpiece occurs so that, for example, a flat workpiece becomes convex. Consequently, known processes for blasting are not completely satisfactory for some purposes.

Accordingly, it is an object of this invention to provide an improved blasting process for use on soft, nonferrous metals, such as aluminum, zinc, copper, brass and lead, in order to produce a high luster satin mat finish without substantial alteration of the shape of the workpiece and without creating material stresses in the surface layer of the workpiece.

According to the invention, there is provided a blasting process in which shot-like synthetic resin particles are used as the blasting agents in order to effect formation of the satin mat finish on the workpiece. The resins used should have a thermal softening point in excess of about 200 degrees Fahrenheit so that they will not soften to any appreciable extent during the shot blasting procedure. The resins should have a hardness of about between 75 and 125 as measured on the Rockwell M scale under standard test conditions. The particles desirably should have a size of between about 20 and 80 mesh (Tyler standard). The particles ordinarily are suspended in a suitable liquid carrier, usually water, which may have a rust preventative, such as suitable oils, chromate salts etc. added to it. The carrier liquid can be heated if desired. Conventional blasting pressures can be used, such as from 40 p.s.i. to 100 p.s.i.

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The resins also should have substantial elasticity so that the impact energy will be absorbed at least in part by elastic deformation of the particles rather than being applied entirely to the metal surface being treated.

The resin particles used should be substantially free of any sharp edges because these will cause a reduction in the luster or brightness of the metal surface that is treated. In the claims, the term "round-edged particles" shall refer to particles having an external surface substantially free of any sharp cutting edges. It is to be understood that such particles may have an irregular shape. Also, the use of this term shall not preclude the possibility of the presence of minor amounts of particles having some sharp edges so long as the amount of sharp edges is so small that it has no substantial effect on the results.

Polyester resin particles presently are preferred for use in the invention. Particles made of phenol-formaldehyde resins also are satisfactory although they have a pronounced smell which makes their use undesirable in many instances. Particles made of other resins, either thermosetting or thermoplastic, can be used, such as polyvinyl chloride resin. Acrylic resins, epoxy resins and urea-formaldehyde resins having the qualities and characteristics referred to above also have been found to be satisfactory for the purposes of the invention.

The amount of stock removed will increase if the blasting pressure is increased. However, the amount of stock removal will decrease as the temperature of the resin particles rises.

In order to further illustrate the invention the results of several tests are given hereinbelow to provide a comparison of the results achieved with synthetic resin particles with the results achieved with aluminum oxide and/or glass bead particles. In each instance, the test conditions were the same, only the type of particles was changed. The tests were run on similar aluminum plates (.3 mm. thick, 10 cm. sq.). Blasting distance—10 cm. Concentration of blasting particles—5 kg. per 15 l. water.

EXAMPLE I

Comparison of surface luster as measured with an N.F. roughness gauge (perfect mirror finish has a reading of 10):

Al ₂ O ₃	Scale out
Glass beads	180
Phenol-formaldehyde resin	126

EXAMPLE II

Comparison of surface hardness as measured by a Micro-Vickers Hardness Tester:

Kind of Particles Blasted	Surface Hardness			
	Before Blasting	Blasting Pressure		
		2 kg./cm. ²	3	4
Glass Beads	47.8	50.9	51.8	55.1
Polyester Resin	47.8	48.1	48.1	48.6

EXAMPLE III

Depth of concavity formed in workpiece as measured in millimeters:

Blasting Pressure (kg./cm. ²)	1	2	3	4	5
Phenol Resin	1.	1.5	2.0	3.0	3.5
Glass Beads	6.	7.	8.	13.0	15.0

EXAMPLE IV

Aluminum plates were blasted with acrylic resin particles (ASTM D-788-56T Grade 6). The blasting pressure was varied between 2 kg./cm.² and 5 kg./cm.² and all other conditions remained constant. The plates

after blasting had a high luster satin mat finish. The following table lists the data with respect to the amount of metal removed from the test pieces.

Type of Resin	Blasting Pressure (kg./cm. ²)	Test Piece Weight (g.)		Metal Removed (mg.)
		Before Blasting	After Blasting	
Acrylic-----	2	26.8635	26.8605	3.0
	2	26.8055	26.8030	2.5
	3	26.0105	26.0075	3.0
	3	26.3675	26.3640	3.5
	4	26.4705	26.4665	4.0
	4	26.6905	26.6870	3.5
	5	26.3730	26.3685	4.5
	5	26.1245	26.1200	4.5

EXAMPLE V

Aluminum sheets were blasted with urea-formaldehyde particles with the following results. The sheets after blasting had a high luster satin mat finish.

Type of Resin	Blasting Pressure (kg./cm. ²)	Metal Removed (g.)	Depth of Depression in Workpiece (mm.)
Urea-Formaldehyde----	2	0.0014	3.164
	3	0.0082	4.834
	4	0.0098	5.832
	5	0.0322	5.649

EXAMPLE VI

Aluminum sheets were blasted with epoxy resin particles with the following results. The sheets after blasting had a high luster satin mat finish.

Type of Resin	Blasting Pressure (kg./cm. ²)	Metal Removed (mg.)
Epoxy-----	2	2
	3	4
	4	5
	5	5

Although a particular preferred embodiment of the invention has been described above in detail for illustrative purposes, it will be recognized that variations or modifica-

tions of such disclosure, which lie within the scope of the appended claims, are fully contemplated.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A process for surface treatment of relatively soft nonferrous metal pieces comprising peening to a high luster satin mat finish without substantial surface deformation or surface stress formation by subjecting the metal pieces to a blasting stream comprising a carrying fluid charged with round-edged, shot-like elastic synthetic resin particles of about 20-80 Tyler mesh size having no thermal softening point below about 200 degrees Fahrenheit and a hardness of about between 75 and 125 Rockwell M.

2. A process according to claim 1, in which the blasting stream comprises water.

3. A process according to claim 2, in which the blasting stream comprises water, the metal is aluminum, and the synthetic resin particles are composed of a thermosetting resin.

4. A process according to claim 1, in which the particles are composed of a resin selected from the group consisting of polyester resins, phenolformaldehyde resins, acrylic resins, epoxy resins and urea-formaldehyde resins.

5. A process according to claim 2, in which the water contains a rust preventative.

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